AMENDMENTS TO THE CLAIMS

1. (currently amended) A two-stage method for characterizing a spatial arrangement among data points for each of a plurality of three-dimensional time series distributions comprising a sparse number of said data points, said method comprising the steps of:

creating a first virtual volume containing a first three-dimensional time series distribution of said data points to be characterized;

subdividing said first virtual volume into a plurality *k* of three-dimensional volumes, each of said plurality *k* of three-dimensional volumes having the same shape and size;

providing a first stage characterization of said spatial arrangement of said first three-dimensional time series distribution of said data points comprising the steps of[[;]]:

determining a statistically expected proportion Θ of said plurality *k* of three-dimensional volumes containing at least one of said data points for a random distribution of said data points such that *k*

* Θ is a statistically expected number [[M]] of said plurality *k* of three-dimensional volumes which contain at least one of said data points if said first three-dimensional time series distribution is characterized as random;

counting a number *m* of said plurality *k* of three-dimensional volumes which actually contain at least one of said data points in said first three-dimensional time series distribution, wherein M is the symbolic alphabetical character assigned to be the parameter representing $k$ * Θ in mathematical statements and m is a representation of M in a given spatial arrangement undergoing processing in accordance with the method;

statistically determining an upper random boundary $m_2$ greater than M and a lower random ~~barrier~~ boundary $m_1$ less than M such that if said number *m* is between said upper random ~~barrier~~ boundary and said lower random barrier then said first three-dimensional time series distribution is characterized as random in structure during said first stage characterization;

providing a second stage characterization of said first three-dimensional time series distribution of said data points comprising the steps of[[;]]:

when Θ is less than a pre-selected value, then utilizing a Poisson distribution to determine a first mean of said data points;

when Θ is greater than said pre-selected value, then utilizing a binomial distribution to determine a second mean of said data points;

computing a probability *p* from said first mean or from said second mean depending on whether Θ is greater than or less than said pre-selected value;

determining a false alarm probability $\alpha$ based on a total number of said plurality *k* of three-dimensional volumes for said first three-dimensional time series distribution of said data points to be characterized;

comparing $p$ with $\alpha$ to determine whether to characterize said sparse number of said data points as noise or signal during said second stage characterization; and

comparing said first stage characterization of said first three-dimensional time series distribution of said data points with said second stage characterization of said first three-dimensional time series distribution of said data points to determine presence of randomness in said first three-dimensional time series ~~distributions~~ distribution.

2. (currently amended) The two-stage method of claim 1, wherein if said first stage characterization of said first three-dimensional time series distribution of said data points indicates a random distribution and said second stage characterization of said first three-dimensional time series distribution of said data points indicates a signal, then ~~continuing~~ continue to process said data points.

3. (currently amended) The two-stage method of claim 1, wherein if said first stage characterization of said first three-dimensional time series distribution of said data points indicates

a random distribution and said second stage characterization of said first three-dimensional time series distribution of said data points indicates a random distribution, then labeling said first three-dimensional time series distribution of said data points as random.

4. (currently amended) The two-stage method of claim 1, further comprising utilizing the method steps of claim 1 for characterizing each of said plurality of three-dimensional time series ~~distribution~~ distributions of said data points.

5. (currently amended) The two-stage method of claim 1, wherein said first three-dimensional time series distribution of said data points comprises less than about twenty-five (25) data points.

6. (currently amended) The two-stage method of claim 1, wherein said upper random boundary greater than M and said lower random barrier less than M are computed utilizing binomial probabilities.

7. (currently amended) The two-stage method of claim 1, further comprising obtaining each of said plurality of three-dimensional time series distributions comprising said sparse number of said data points from a sonar system.

8. (currently amended) The two-stage method of claim 1, further comprising obtaining each of said plurality of three-dimensional time series distributions comprising said sparse number of said data points from a radar system.

9. (currently amended) The two-stage method of claim 1, further comprising determining said false alarm probability $\alpha$ based on a total number of said plurality $k$ of three-dimensional volumes for said first three-dimensional time series distribution of said data points to be characterized wherein:

$$\begin{aligned}&\alpha = 0.01 \ if \ k \geq 25, and\\ &\alpha = 0.05 \ if \ k < 25.\end{aligned}$$

10. (currently amended) The two-stage method of claim 1, wherein said step of comparing $p$ with $\alpha$ to determine whether to characterize said sparse number of said data points as noise or signal during said first stage characterization is mathematically stated as:

$$\begin{aligned}&if \ p \geq \alpha \Rightarrow NOISE, and\\ &if \ p < \alpha \Rightarrow SIGNAL.\end{aligned}$$

11. (currently amended) The two-stage method of claim 1, wherein said pre-selected value is equal to 0.10 such that if

$\Theta \leq 0.10$, then said Poisson distribution is utilized, and if

$\Theta > 0.10$, then said binomial distribution is utilized.

12. (currently amended) The two-stage method of claim 1, wherein a total number Y of said data points is given by $Y = \sum_{k=0}^{K} kN_k$, where:

| ***k*** (number of cells with points) | ***N<sub>k</sub>*** (number of points in *k* cells) |
|---|---|
| 0 | $N_0$ |
| 1 | $N_1$ |
| 2 | $N_2$ |
| 3 | $N_3$ |
| ⋮ | ⋮ |
| K | $N_k$ |

.

13. (currently amended) The two-stage method of claim 12, wherein said step of computing said probability *p* from said first mean further comprises utilizing the following equation:

$$\cancel{p = P\left(\left|z_p\right| \leq Z\right) = 1 - \frac{1}{\sqrt{2\pi}} \int_{-|z_p|}^{+|z_p|} \exp(-.5x^2)dx}$$

$$\underline{p = P\left(\left|z_p\right| \leq Z\right) = 1 - \frac{1}{\sqrt{2\pi}} \int_{-|z_p|}^{+|z_p|} \exp(-.5x^2)dx}$$

where $\cancel{Z_P = \frac{Y - N\mu_0}{\sqrt{N\mu_0}}}$ $\underline{Z_P = \frac{Y - N\mu_0}{\sqrt{N\mu_0}}}$

<u>where P refers to probability,</u>

<u>where Z is the theoretical Gaussian continuous probability distribution,</u>

<u>where X is the "dummy variable" of integration in the integrand,</u>

where Y is said total number of data points,

where, N is a sample size of said data points for each of a plurality of three-dimensional time series distributions, and

$\cancel{\mu_0 = \frac{\sum_{k=0}^{K} kN_k}{\sum_{k=0}^{K} N_k}}$ $\underline{\mu_0 = \frac{\sum_{k=0}^{K} kN_k}{\sum_{k=0}^{K} N_k}}$ is said first mean.

14. (currently amended) [[A]] <u>The two-stage</u> method according to claim 13, wherein said step of computing said probability *p* from said second mean further comprises utilizing the following equation:

$$\cancel{p = P(|z_B| \le Z) = 1 - \frac{1}{\sqrt{2\pi}} \int_{-|z_B|}^{+|z_B|} \exp(-.5x^2)dx}$$

$$p = P\left(\left|z_B\right| \le Z\right) = 1 - \frac{1}{\sqrt{2\pi}} \int_{-|z_B|}^{+|z_B|} \exp(-.5x^2)dx$$

where $\cancel{Z_B = \frac{m \pm c - k\theta}{\sqrt{k\theta(1-\theta)}}}$ $Z_B = \frac{m \pm c - k\theta}{\sqrt{k\theta(1-\theta)}}$

where $c$ is a correction factor.

15. (currently amended) The two-stage method of claim [[1]] 12, wherein said plurality $k$ of three-dimensional volumes into which said first virtual volume is subdivided is determined from the relation

$$\cancel{k = \begin{cases} k_I \text{ if } K_I > K_{II} \\ k_{II} \text{ if } K_I < K_{II} \\ \max(k_I, k_{II}) \text{ if } K_I = K_{II} \end{cases}},$$

$$k = \begin{cases} k_I \text{ if } K_I > K_{II} \\ k_{II} \text{ if } K_I < K_{II} \\ \max(k_I, k_{II}) \text{ if } K_I = K_{II} \end{cases}$$ where

$$\cancel{k_I = \text{int}\left(\frac{\Delta t}{\delta_I}\right) * \text{int}\left(\frac{\Delta Y}{\delta_I}\right) * \text{int}\left(\frac{\Delta Z}{\delta_I}\right)},$$

$$k_I = \text{int}\left(\frac{\Delta t}{\delta_I}\right) * \text{int}\left(\frac{\Delta Y}{\delta_I}\right) * \text{int}\left(\frac{\Delta Z}{\delta_I}\right)$$

$$\cancel{k_{II} = \text{int}\left(\frac{\Delta t}{\delta_{II}}\right) * \text{int}\left(\frac{\Delta Y}{\delta_{II}}\right) * \text{int}\left(\frac{\Delta Z}{\delta_{II}}\right)},$$

$$k_{II} = \text{int}\left(\frac{\Delta t}{\delta_{II}}\right) * \text{int}\left(\frac{\Delta Y}{\delta_{II}}\right) * \text{int}\left(\frac{\Delta Z}{\delta_{II}}\right)$$

$$\cancel{\delta_I = \sqrt[3]{\frac{\Delta t * \Delta Y * \Delta Z}{k_0}}},\qquad \underline{\delta_I = \sqrt[3]{\frac{\Delta t * \Delta Y * \Delta Z}{k_0}}}$$

$$\cancel{k_0 = \begin{cases} k_1 \text{ if } |N-k_1| \le |N-k_2| \\ k_2 \text{ otherwise} \end{cases}},\qquad \underline{k_0 = \begin{cases} k_1 \text{ if } |N-k_1| \le |N-k_2| \\ k_2 \text{ otherwise} \end{cases}}$$

$$\cancel{k_1 = \left[\operatorname{int}\left(N^{\frac{1}{3}}\right)\right]^3},\qquad \underline{k_1 = \left[\operatorname{int}\left(N^{\frac{1}{3}}\right)\right]^3}$$

$$\cancel{k_2 = \left[\operatorname{int}\left(N^{\frac{1}{3}}\right)+1\right]^3},\qquad \underline{k_2 = \left[\operatorname{int}\left(N^{\frac{1}{3}}\right)+1\right]^3}$$

$$\cancel{\delta_{II} = \sqrt[3]{\frac{\Delta t * \Delta Y * \Delta Z}{N}}},\qquad \underline{\delta_{II} = \sqrt[3]{\frac{\Delta t * \Delta Y * \Delta Z}{N}}}$$

$$\cancel{\mathrm{K}_I = \frac{k_I}{\Delta t * \Delta Y * \Delta Z}\delta_I^3 \le 1},\qquad \underline{\mathrm{K}_I = \frac{k_I}{\Delta t * \Delta Y * \Delta Z}\delta_I^3 \le 1}$$

$$\cancel{\mathrm{K}_{II} = \frac{k_{II}}{\Delta t * \Delta Y * \Delta Z}\delta_{II}^3 \le 1},\qquad \underline{\mathrm{K}_{II} = \frac{k_{II}}{\Delta t * \Delta Y * \Delta Z}\delta_{II}^3 \le 1}$$

<u>N is the Maximum number of data points in the distribution,</u>

$\Delta t$ is time interval for collecting each of said plurality of three-dimensional time series distributions,

$\Delta Y = \max(Y) - \min(Y)$ where $Y$ is a magnitude of a first measure of said data points between a maximum and minimum value, and a second measure referred to as $Z$ with magnitude $\Delta Z = \max(Z) - \min(Z)$ where $Z$ is

a magnitude of a second measure of said data points between a maximum and minimum value, and

*int* is the integer operator.